

[1]Benzothiopyrano[4,3-*b*]indoles, a New Family of *pseudo*-Azulenes

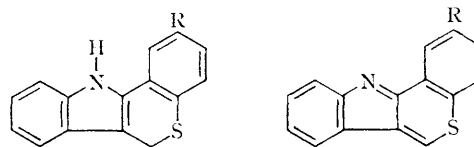
By N. P. BUU-HOÏ, A. CROISY, A. RICCI, P. JACQUIGNON, and F. PÉRIN

(Institut de Chimie des Substances Naturelles du C.N.R.S., 91-Gif-sur-Yvette, France)

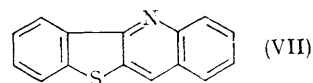
By *pseudo*-azulenes, a class of compounds much explored in recent years,¹ is commonly meant heterocyclic iso- π -electronic analogues of hydrocarbons bearing an azulene skeleton. We wish to report a new family of compounds of this type, containing both a sulphur and a nitrogen heteroatom, and particularly easy to prepare.

When 6,11-dihydro[1]benzothiopyrano[4,3-*b*]indole (I), the product of the Fischer indolisation of thiachroman-4-one phenylhydrazone,² was treated with picric acid in boiling ethanol, a mixture of two picrates was obtained, one being the picrate of (I) (violet-black needles, m.p. 114°, from cyclohexane), and the other a yellow compound, m.p. *ca.* 267° (decomp > 230°), from ethanol, which was the picrate of the dehydrogenation product of (I), *i.e.*, of [1]benzothiopyrano[4,3-*b*]indole (IV). This last substance (orange prisms, m.p. 165°, from cyclohexane), which had obviously formed under the oxidising influence of picric acid (this oxidation is not photochemical, as it could be carried out in the dark), could also be prepared photochemically, by a brief irradiation of an aerated benzene solution of (I) with ultraviolet light. Unlike (I), it showed pronounced basic properties, giving a yellow water-soluble hydrochloride, m.p. 235°; electronically, it is an iso- π -electronic analogue of 2,3:7,8-dibenzazulene.

This tendency of 6,11-dihydro[1]benzothiopyrano[4,3-*b*]indole (I) to undergo conversion into the corresponding *pseudo*-azulene is general to compounds of this type. For instance, compound (II), m.p. 172°, was readily dehydrogenated



- | | |
|--------------|-------------|
| (I) R = H | (IV) R = H |
| (II) R = Me | (V) R = Me |
| (III) R = Cl | (VI) R = Cl |



by picric acid in ethanol to 2-methyl[1]benzothiopyrano[4,3-*b*]indole (V) (orange-red needles, m.p. 127°); yellow picrate, m.p. *ca.* 280°; yellow hydrochloride, m.p. 232°. Similarly, the chloro-compound (III), yellowish needles, m.p. 162°, gave 2-chloro[1]benzothiopyrano[4,3-*b*]indole (VI) (orange prisms, m.p. 216°).

All the analytical and spectroscopic data recorded are consistent with the structures reported. For instance, the n.m.r. spectrum of (I) (taken with a Varian A-60 apparatus, in deuteriochloroform, and with tetramethylsilane as reference) showed eight aromatic protons (between 6.9 and 7.6 p.p.m.), the proton characteristic of the -NH group (8.1 p.p.m.), and the two protons corresponding to the -S-CH₂ group (4.2 p.p.m.). By contrast, the n.m.r. spectrum of the dehydrogenation product (IV) showed the presence of only nine protons, all of which are "aromatic" (7.1—9.2 p.p.m.); also consistent with the structure postulated is the absence of an -NH group, as

shown by a negative deuteration experiment. The possibility of a rearrangement occurring during dehydrogenation, leading to a fused thianaphthen-quinoline system, is excluded by the fact that compound (IV) is different from thiaquindoline (VII), which is a colourless substance, m.p. 172°.³

Apart from their interest as *pseudo*-azulenes, compounds such as (IV), (V), and (VI) are structural analogues of carcinogenic benz[*c*]acridines;⁴ they, and a number of similar compounds we have prepared, are now under biological testing.

(Received, January 26th, 1966; Com. 052.)

¹ G. V. Boyd, *J. Chem. Soc.*, 1958, 1978; 1959, 55; M. Los and W. H. Stafford, *ibid.*, 1959, 1680; D. Leaver, J. Smolicz, and W. H. Stafford, *ibid.*, 1962, 740; R. Mayer and U. Weise, *Naturwiss.*, 1958, 45, 312; A. G. Anderson, Jr., and L. L. Replege, *J. Amer. Chem. Soc.*, 1961, 83, 3333; D. Sullivan and R. Pettit, *Tetrahedron Letters*, 1963, 401.

² A. K. Kiang and F. G. Mann, *J. Chem. Soc.*, 1951, 1909; T. E. Young and P. H. Scott, *J. Org. Chem.*, 1965, 30, 3613.

³ E. Noelting and A. Herzbaum, *Ber.*, 1911, 44, 2585.

⁴ Cf. A. Lacassagne, N. P. Buu-Hoï, R. Daudel, and F. Zajdela, *Adv. Cancer Res.*, 1956, 4, 315.